

Remarks/Arguments

Rejection under 35 U.S.C. § 103

The examiner rejected claims 1-49 as obvious over Kharitonov (U.S. Pat. No. 5,110,995). The examiner contends that:

The difference between the presently claimed invention and the Kharitonov et al. reference is that the Kharitonov et al. reference teaches a temperature range from about 275 C to 450 C and is silent about the reaction pressure of their process.

Final action, p. 3. The examiner contends that the claim language is not limited to a process where at least a portion of the benzene is in liquid phase, and contends that Kharitonov does not teach or suggest that their process is a gas phase process. Final action, p. 3. The examiner concludes that the “presently claimed temperature of about 270 C is sufficiently close to the temperature of about 275 C taught by Kharitonov” to be a “difference in degree” which would not be rendered patentably distinct from the prior art.

Response

Contrary to the examiner’s contention, the claims **are** limited to a process where at least a portion of benzene is in the liquid phase. Applicant respectfully directs the examiner’s attention to the first paragraph after the preamble of the claim 1, which reads:

continuously contacting, in a distillation column reactor comprising a reaction zone and a distillation zone, benzene with a zeolite catalyst effective to hydroxylate benzene and an oxidant at a temperature in the range of from above 100°C to 270°C thereby producing a hydroxylated product, **wherein at least a portion of said benzene being in a liquid phase;**

Emphasis added. See also independent claims 30 and 38.

The discovery of an optimum value of a variable in a known process normally is an obvious variation. However, there are exceptions to this rule. One exception is where

“the parameter optimized was not recognized to be a result-effective variable.” *In re Antonie*, 559 F.2d 618, 620, 195 U.S.P.Q. 6, 8 (C.C.P.A. 1977); MPEP 2144.05 (2100-120).

The temperature range recited in the pending claims (from above 100°C to 270°C) is not just a difference in degree from the ranges taught by the Kharitonov patent (275° C. to 450° C.), as the examiner contends. The claimed lower temperatures achieve a different result--maintaining a portion of benzene in the liquid phase. The importance of this limitation, and the resulting difference, is explained in the specification:

More particularly, the invention relates to a catalytic distillation process for the oxidative hydroxylation of benzene to form at least one hydroxylated derivative at a temperature and a pressure that **maintains at least a portion of the benzene in the liquid phase and manages the heat generated by the exothermic hydroxylation reaction.** Benzene can be hydroxylated to produce phenol and dihydroxylated products such as, for example, resorcinol, catechol and hydroquinone. **Reflux of the un-reacted benzene renders the reaction substantially isothermal. Reduced operating temperatures and heat management maximize the catalyst life by reducing catalyst coking. The selectivity of the conversion of the oxidant to hydroxylated product also is increased to at least about 90 mol %, preferably to at least about 95 mol %, most preferably to at least about 99 mol %.**

Specification, page 3, ll. 17-33.

As seen from the foregoing, maintaining at least a portion of benzene in a liquid phase “manages the heat generated by the exothermic hydroxylation reaction.” Kharitonov does teach that “[t]he process of oxidation of benzene or derivatives thereof is an exothermal reaction.” Kharitonov, col. 4, ll. 39-40. However, Kharitonov teaches an entirely different solution to this problem: “Hence, it is advisable to use an **inert gas which lowers the thermal load on the catalyst.** This makes it possible to avoid catalyst overheating and contributes to elevation of the reaction selectivity in respect of the desired products.” Kharitonov, col. 4, ll. 40-44 (emphasis added).

The examiner has not pointed to a teaching or suggestion that would motivate a person of ordinary skill in the art to modify the reaction taught in the Kharitonov patent to lower the reaction temperature sufficiently to maintain a portion of benzene in a liquid phase in order to lower the thermal load on the catalyst or to “manage[] the heat generated by the exothermic hydroxylation reaction.”

The examiner cannot establish *prima facie* obviousness of this claimed feature merely by arguing that persons of ordinary skill in the art could derive the claimed invention by modifying the Kharitonov patent to maintain at least a portion of benzene in liquid phase. In order to establish *prima facie* obviousness of the claims, which include this “result-effective variable” the examiner has the burden to point to a teaching or suggestion in the **references themselves** that it would be desirable to make such a modification. MPEP 2143.01; *In re Brouwer*, 37 U.S.P.Q.2d 1663, 1666 (Fed. Cir. 1995).

The examiner has not pointed to any such teaching in the Kharitonov patent, or elsewhere. In fact, Kharitonov specifically teaches away from using the claimed lower temperatures:

Only the use of zeolite catalysts of the above-mentioned composition and of a process temperature within the range of 275° C. to 450° C. makes it possible to accomplish the object of the present invention: to increase the yield of the desired product, e.g. phenol, up to 38%.

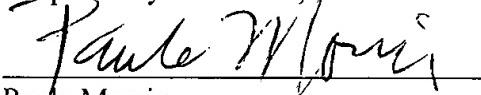
Kharitonov, col. 4, ll. 10-15. This conclusion is supported by the data in Table 1. As the temperature (T, °C) goes up in Table 1, the “Yield of C₆H₅OH S, %” goes up. The foregoing teaches away from decreasing the temperature to the claimed range of from above 100°C to 270°C, and maintaining at least a portion of benzene in a liquid phase. This is "strong evidence of unobviousness." *In re Hedges*, 228 U.S.P.Q. 685, 687 (Fed.

Cir. 1986), quoting *W. L. Gore & Assoc. v. Garlock, Inc.*, 220 U.S.P.Q.303, 312 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

CONCLUSION

Applicant respectfully requests entry of the amendments, which do not narrow the claims, and allowance of all of the pending claims.

Respectfully submitted,



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